

Title: SALINITY, NUTRIENTS, AND FOOD WEBS IN FLORIDA BAY.

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Project Summary: Florida Bay is a shallow, subtropical lagoon south of Florida and has experienced changes in salinity and ecological characteristics. Increased *Synechococcus* blooms and seagrass die-offs in the last 15 years have led to concerns about the health of this productive and valuable system. Causes for these changes, particularly in the north-central region, are not clear but may relate to hypersalinity, nutrient enrichment, and/or other factors. Ecosystem degradation occurs at elevated salinities, but seagrass die-offs and *Synechococcus* blooms are regional despite comparable salinity changes throughout the bay. Detailed knowledge of biogeochemical and food web dynamics in the different regions is needed to address the problem.

Hypothesis: *High salinities may alter nutrient dynamics and contribute to ecosystem degradation via sulfide formation in the north-central region by inhibiting nitrification/denitrification (a nitrogen [N] removal mechanism) and enhancing dissimilatory nitrate reduction to ammonium (DNRA, a N link), with consequences to food web dynamics.* In this scenario, hypersalinity would cause the nutrient-enriched north-central region to have high sulfide concentrations and lead to high N: phosphorus [P] and ammonium [NH₄⁺]: nitrate [NO₃⁻] ratios, which are conducive to cyanobacteria blooms but detrimental to seagrass productivity. Planktonic protists may supply *Synechococcus* with regenerated P during low allochthonous input, and larger grazers may prevent them from exerting top-down control.

Mechanistic studies are needed to define nutrient and food web dynamics and determine how they are influenced by salinity and

nutrient status. The proposed research will focus on two questions: 1. Why do increased salinities affect ecological conditions in the north-central region more than other regions of Florida Bay despite comparable salinity variations throughout the bay? and 2. What factors allow algal blooms in Florida Bay to persist through dry and wet seasons despite grazing pressure and variations in allochthonous nutrient supply?

Interdisciplinary studies of these issues and interactions will be conducted in four representative regions to define rates and transformations leading to ecosystem degradation or preservation, respectively. Microbial food web studies will be combined with isotope tracer experiments (using labeled N and P compounds) to determine water column nutrient dynamics. Sediment processes will be studied by measuring nutrient fluxes, N-fixation, denitrification, DNRA, and associated food webs, simultaneously, in intact cores under controlled conditions.

Relevance to
Restoration and/or
Resource
Management:

The proposed research will contribute to the program goal of developing predictive capabilities from restoration activities for coastal ecosystems. It will examine how salinity and nutrient biogeochemistry interact to affect food web dynamics and ecosystem health. The data will complement other Florida Bay studies that provide spatial and temporal data on nutrient concentrations and biotic indicators. The proposed project will provide process rate data for models and help managers understand how freshwater and nutrient inputs affect nutrient cycling and ecosystem health. This research will help managers make informed decisions about appropriate remediation actions aimed at improving health and productivity in Florida Bay.

Geographic Area:

Florida Bay.